

What Is Claimed Is:

1. A vane pump comprising:
 - a) a pump housing having an interior chamber that defines a central axis through which a vertical centerline and a horizontal centerline extend;
 - b) a cam member mounted within the interior chamber of the
5 pump housing and having a bore extending axially therethrough and defining a circumferential surface of a pumping cavity, the pumping cavity including a discharge arc region, an inlet arc region and seal arc regions separating the inlet arc region and the discharge arc region from one another; and
 - c) a substantially cylindrical rotor member mounted for rotational
10 movement within the bore of the cam member about the central axis of the interior chamber, the rotor member having a central body portion with first and second axially opposed end surfaces and a plurality of circumferentially spaced apart radially extending vane slots formed therein, each vane slot supporting a corresponding vane element mounted for radial movement therein, each vane element having a radially
15 outer tip surface adapted for slideably engaging the circumferential surface of the pumping cavity and a radially inner undervane portion within each vane slot, the first end surface of the body portion having a circumferential recess formed in a radially outer portion thereof so as to create a leak path for communicating fluid from the discharge arc region to the inlet arc region when the cam member is in a start-up
20 position and an undervane portion of a vane element is positioned radially outward of

a radially inner edge of the recess formed in the first end surface when such vane is positioned in the seal arc region of the pumping cavity.

2. A vane pump as recited in Claim 1, wherein the pump cavity includes a discharge arc region of about 144 degrees, a first seal arc region of about 36 degrees, an inlet arc region of about 144 degrees and a second seal arc region of about 36 degrees.

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3. A vane pump as recited in Claim 1, further comprising first and second axially spaced apart end plates disposed within the interior chamber of the pump housing, each end plate having a first surface which is adjacent to the rotor member, each first surface forming an axial end portion of the pumping cavity.

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4. A vane pump as recited in Claim 3, further comprising means associated with the first surface of each end plate for communicating fluid from the discharge arc region of the pumping cavity to the undervane portion of each vane element when each vane element passes through the discharge and seal arc regions and for communicating fluid from the inlet arc region of the pumping cavity to the undervane portion of each vane element when each vane element passes through the inlet arc regions as the rotor member rotates about the central axis.

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5. A vane pump as recited in Claim 3, wherein the rotor member further comprises a plurality of substantially axial fluid passages formed in the central body portion of the rotor, each passage positioned between the plurality of circumferentially spaced apart radial vane slots and providing a path through the rotor body portion for fluid to communicate axially from the pumping cavity to the first and second end plate.

6. A vane pump as recited in Claim 1, wherein the radially inner edge of the circumferential recess formed in the first end surface of the rotor member is spaced from the central axis by a radial distance, the radial distance defining an amount of allowable vane tip surface wear which can occur before high pressure fluid can leak from the discharge arc region to the inlet arc region of the pumping cavity.

7. A vane pump as recited in Claim 1, wherein the second end surface of the body portion of the rotor member has a circumferential recess formed in a radially outer portion thereof so as to create a leak path for communicating fluid from the discharge arc region to the inlet arc region when the cam member is in a start-up position and an undervane portion of a vane element is positioned radially outward of a radially inner edge of the recess formed in the second end surface when such vane is positioned in the seal arc region of the pumping cavity.

8. A vane pump comprising:

a) a pump housing having a cylindrical interior chamber defining a central axis through which a vertical centerline and a horizontal centerline extend;

b) a cam member mounted within the interior chamber of the
5 pump housing and having a bore extending therethrough and defining a circumferential surface of a pumping cavity, the pumping cavity including a discharge arc region, an inlet arc region and seal arc regions separating the inlet arc region and the discharge arc region from one another; and

c) a rotor member mounted for rotational movement within the
10 bore of the cam member about the central axis of the interior chamber, the rotor member having a central body portion which includes first and second axially opposed end surfaces and a plurality of circumferentially spaced apart radially extending vane slots formed therein, each vane slot supporting a corresponding vane element mounted for radial movement therein, each vane element having a radially
15 outer tip surface adapted for slideably engaging the circumferential surface of the pumping cavity and a radially inner undervane portion within each vane slot, the first end surface of the body portion having a circumferential recess formed therein and extending between each vane slot, wherein the circumferential recess is adapted and configured to provide a path for high pressure fluid to leak from the discharge arc
20 region to the inlet arc region of the pumping cavity when each vane tip surface has worn such that the undervane portion is positioned radially outward of a radially inner edge of the recess.

9. A vane pump as recited in Claim 8, wherein the pump cavity includes a discharge arc region of about 144 degrees, a first seal arc region of about 36 degrees, an inlet arc region of about 144 degrees and a second seal arc region of about 36 degrees.

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10. A vane pump as recited in Claim 8, further comprising first and second axially spaced apart end plates disposed within the interior chamber of the pump housing, each end plate having a first surface which is adjacent to the rotor member, each first surface forming an axial end portion of the pumping cavity.

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11. A vane pump as recited in Claim 10, further comprising means associated with the first surface of each end plate for communicating fluid from the discharge arc region of the pumping cavity to the undervane portion of each vane element when each vane element passes through the discharge and seal arc regions and for communicating fluid from the inlet arc region of the pumping cavity to the undervane portion of each vane element when each vane element passes through the inlet arc regions as the rotor member rotates about the central axis.

12. A vane pump as recited in Claim 10, wherein the rotor member further comprises a plurality of substantially axial fluid passages formed in the central body portion of the rotor, each passage positioned between the plurality of circumferentially spaced apart radial vane slots and providing a path through the rotor

- 5 body portion for fluid to communicate axially from the pumping cavity to the first and second end plate.

13. A vane pump as recited in Claim 8, wherein the radially inner edge of the circumferential recess formed in the first end surface of the rotor member is spaced from the central axis by a radial distance, the radial distance defining an amount of allowable vane tip surface wear which can occur before high pressure fluid
5 can leak from the discharge arc region to the inlet arc region of the pumping cavity.

14. A vane pump as recited in Claim 8, wherein the second end surface of the body portion of the rotor member has a circumferential recess formed in a radially outer portion thereof so as to create a leak path for communicating fluid from the discharge arc region to the inlet arc region when the cam member is in a start-up
5 position and an undervane portion of a vane element is positioned radially outward of a radially inner edge of the recess formed in the second end surface when such vane is positioned in the seal arc region of the pumping cavity.